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CASE REPORT

NON-SPLITTED MANDIBULAR FULL ARCH PROSTHESIS WITH MODIFIED PEEK MATERIAL – A CASE REPORT

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ABSTRACT

The preferred approach for mandibular full arch prosthesis is placement of implants between and beyond the mental foramen for better stress distribution and elimination of cantilevers. The rigid framework over these implants is splitted to overcome the action of mandibular flexion. However, in situations of unavailability of bone in posterior mandible, the traditional branemark approach of placing 4 to 6 implants between mental foramen is used. In such cases, when a continuous rigid cobalt chrome or zirconia framework is used, the increased cantilever lengths and mandibular flexion causes stress at bone implant interface. To avoid this, the framework should be selected of a material which has modulus of elasticity close to that of bone. A new upcoming modified PEEK material, with combination of rigidity and elasticity close to human bone, is a more natural material for implant prosthesis.

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INTRODUCTION

Restorative dentistry has been gradually progressing since a long time. Previously, before the invention of implants, complete dentures or partial dentures for missing teeth and missing alveolar bone were the only options. After the advancement of restorative dentistry and the introduction of dental implants, there has been an addition of several new implant retained prosthetic options. Implants can retain fixed teeth as well as removable complete dentures or partial dentures. Implants also retain several maxillofacial reconstructive prosthesis. Along with the surgical placement of implants, the prosthetic placement is very important. Poor prosthetic placement causes unbalanced force distribution on implants. Due to lack of periodontal ligaments in implants (unlike the natural teeth) the stress bearing capacity of implants is lower than natural teeth. Hence a lot of consideration and planning is required for the prosthetic design and occlusal scheme of the restoration (Danny Omar Mendoza Marin *et al.,* 2015). A modified poly-ether-ether-ketone (PEEK) material, is a biocompatible, nonallergic, rigid material, with comparable flexibility to bone, high polishing and low absorption properties, low plaque affinity and good wear resistance. It has been used for years in orthopedics and medical technology.

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It is now being introduced as an excellent material as substitute to zirconia and other metal free alloys for framework fabrication of dental implants. The elasticity of the material, which lies within the range of bone, makes it a more natural material, as it is able to compensate for the torsion of bone, in particular in the case of larger implant framework crossing mental foramen (Zoidis *et al.,* 2016). This case report describes a case of a single unit implant supported prosthesis with distal cantilever fabricated with modified PEEK material.

CASE REPORT

A 35 years female reported to department of prosthodontics, Dr. D.Y. Patil Dental college and hospital to restore her missing teeth and some grossly destructed teeth. Patient complained of missing teeth causing inability to eat properly, accompanied by poor esthetics. Patient wanted a fixed restoration which would help her to eat satisfactorily and also improve her esthetics. On examination, grossly destructed teeth were 12,15,27. Root pieces were found with17,34,35. Caries were found with 11, 13, 16, 26, 32, 42. Mobility and lingual recession was noticed with 31, 41, 42.

Missingteeth were 22, 24, 25, 36, 37, 44, 45, 46, 47.

The medical history of the patient was non-contributory. The diagnostic impressions of the patient were made and a diagnostic mounting of the casts was done using a face bow transfer.

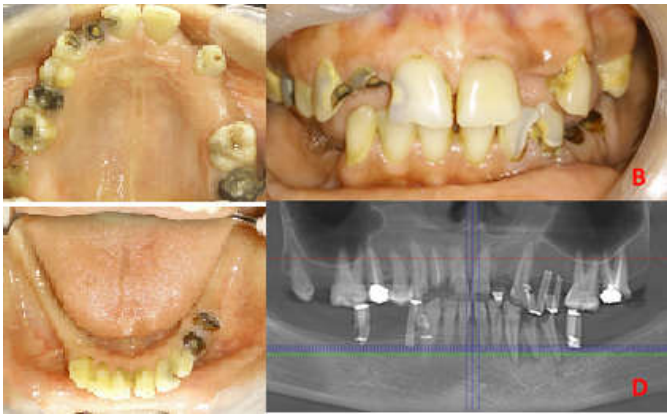

Figure 1. Intraoral view, Radiograph

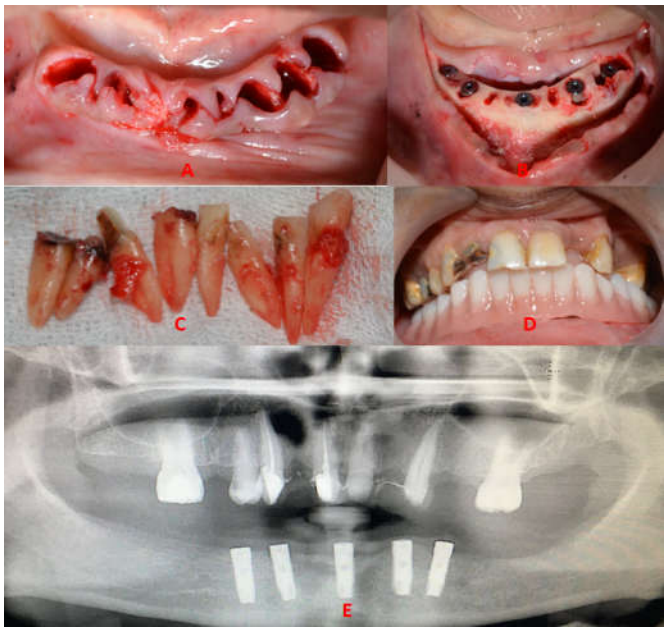

Figure 2. Extraction, Implant placement, Immidiate denture delivery, Post implant OPG

Also, a Pre-operative CBCT with radiological stents was carried out for finalising the treatment plan. The patient being a young female, insisted on a completely fixed prosthesis, which will help her to eat properly and look better. Taking into consideration the patients requirement and on studying the diagnostic models and CBCT, a treatment plan was formulated. For the maxillary arch, teeth number 12,15,17,27 were found to be grossly destructed 34,35 for mandibular arch and beyond restoration. Hence they were planned to be extracted. The teeth number 11 and 13 were found to be restorable after root canal treatment. For the lower arch, patient wanted a fixed implant supported prosthesis. However, the CBCT showed that the bone in the posterior region was inadequate for placing implants beyond the mental foramen. The mandibular incisors were carious, with recession and mobility. They were found to have poor prognosis. Hence it was decided to extract the lower anteriors and 34, 35, place 5 implants in the inter – mental foramina region at A,B,C,D,E positions and give a fixed prosthesis with distal cantelevers. Considering the implant planning and prosthesis design, it was decided to use a PEEK framework to reduce the stress on the implants due to the cantilever and to provide a framework having the modulus of elasticity closer to that of bone. The following procedures were carried out: upper and lower alginate impressions and facebow transfer for the fabrication of surgical stent and lower immediate denture was made. Surgical extraction of all grossly destructed teeth was done as planned and simultaneous placement of 5 implants in lower arch was performed. Patient was given an immediate denture to maintain vertical height, and provide wound coverage and aesthetics. Root canal treatment was done for upper right central incisor and canine. Composite restorations were done in the remaining carious teeth. Implants were placed as planned before and site was well sutured. An healing time of 3 months was given for good osseointegration. Stage two surgery was performed after 3 months from placement of implants. Final implant level impression was taken. A wax rim was fabricated over it with the reference of old immediate denture as a guide for vertical dimention. The lower rim and upper casts were mounted on a semi adjustable articulator with help of wax bite. Lower and upper teeth wax up was done to set adequate anterior guidance. Diagnostic Broderick's analysis was done to determine occlusal plane for posteriors. Upper anteriors and posteriors were prepared to receive porcelain fused to metal restorations with the guide of lower wax rims. Final crowns were cemented followed by wax try in of lower arch. The lower wax try in was checked for correct occlusion and indexed in polyvinyl siloxane. The non engaging plastic abutments were placed on final cast and splinted to perform jig trial.

Figure 3. Maxillary final crowns and bridge cemented, Final Lower Impressions, Intra-Oral try-in, UCLA casted in Co-Cr, PEEK framework fabrication, Composite wrapup, Intraoralview of final prosthesis

Figure 4. Before treatment Intraoral view, After treatment intraoral view

The plastic abutments were then casted into cobalt – chromium and the abutments were checked for fit. The modified PEEK framework was fabricated over the casted abutments. The framework was wrapped with composite as per the putty index of try-in denture done during diagnostics. Occlusal contacts were adjusted in centric and eccentric positions. The final prosthesis was torqueintroraly with 15Ncm torque. The access holes were closed with cotton and fermite (A Composite for implant access hole closure). Patient was instructed to maintain oral hygene with water flosser and interdental brush. The patient was recalled the next day, after 1 week and 1 month. The patient was satisfied with the prosthesis.

DISCUSSION

Mandibular flexure is defined as "the change in shape of the mandible caused by the pterygoid muscles contracting during opening and protrusion movements" (Danny Omar Mendoza Marin *et al.,* 2015). For full arch mandibular prosthesis, the traditional Branemark approach recommended the delayed loading protocol, with 4 or 6 root form implants inserted between the mental foramina (Mathew *et al.,* 2013). These implants are splinted and restored with distal cantilevers of each side to replace the posterior teeth after a healing period. However, drawback of this type of prosthesis can promote a high level of stress that can be harmful to the implant and the surrounding bone as a result of the unfavourable lever arms caused by increased length of cantilevers (Danny Omar Mendoza Marin *et al.,* 2015; Chee and Jivraj, 2006). Hence, another approach includes placing implants beyond the mental foramen to improve the distribution of stress with more favorable implant support, avoiding long cantilevers (Danny Omar Mendoza Marin *et al.,* 2015; Cid *et al.,* 2014). A continuous and rigid framework over these implants can create dangerous stress at the bone/implant interface and at the prosthetic superstructure due to torsion &flexion which occurs during functional and parafunctional loads.[1]Hence, when implants are placed distal to the mental foramen, the mandibular prosthesis is usually restored in 2 or 3 fragments to overcome the problem of mandibular flexion (Danny Omar Mendoza Marin *et al.,* 2015). This is the preferred approach when bone is present in posterior mandible.

However, if due to presence of vital structures and due to unavailability of bone in posterior mandible, it may not be possible to place implants beyond the mental foramen. In such cases, single unit full mouth fixed implant prosthesis has to be fabricated on 5 implants placed between the mental foramen with a distal cantilever. To compensate the drawback of unfavorable lever arms and increased cantilever in these cases, the physical properties of the material used for framework fabrication should be such that, it absorbs the stress created by mandibular flexion. That is, if the complete mandibular implant prosthesis has to be a single unit with cantilevers as per Branemark approach, the material used for it must have the properties of elasticity close to bone while maintaining rigidity of the prosthesis. The modulus of elasticity of metals like cobalt- chromium or zirconia used in framework fabrication have a large modulus of elasticity (6 to 10 times of surrounding bone) causing impaired force transmission at implant-tissue interface (Karan marya *et al.,* 2011). The modulus of elasticity of PEEK material, which lies within the range of bone, makes it a more natural material, as it is able to compensate for the torsion of bone, in particular in the case of more implant placement. Another commonly encountered problems of full arch implant prosthesis is high weight of prosthesis due to the titanium, cobalt chrome or zirconia framework. Compared to conventional prosthesis, the PEEK prosthesis is much less in weight leading increased comfort of the patients. As majority patients with full mouth implants tend to be geriatric patients, the light weight of the prosthesis is better accepted by the patients.

Also, conventional prosthesis pose a problem of increased plaque accumulation requiring additional hygiene maintenance, thus a higher dependency on patient for survival of the implant. Modified PEEK tends to accumulate much less plaque, thus leading to better peri-implant health and maintenance. Modified PEEK has a aesthetic white shade, which supports its use in the field of prosthetics. Its insolubility in water makes it a biocompatible material. This material can be used for patients allergic to metals, or who dislike the metallic taste, the weight, and the unpleasant metal display of the denture framework and retentive clasps. Moreover, demand for metal-free dental prostheses is on the increase, with more and more cases of metal intolerance. This material is lighter and easier to work with in dental laboratories compared to titanium or ceramics. PEEK frameworks can be constructed either via CAD/CAM manufacturing or via the conventional lost wax technique (Zoidis *et al.,* 2016).

Conclusion

Implant dentistry is progressing towards materials which are more biocompatible. Attempts to find better materials which have properties close to the natural bone are constantly in research. Modified PEEK, after being successfully used in humans in orthopedic operations, is the upcoming material in the dental field with a combination of rigidity and elasticity which is close to that of human bone, making it a excellent material for use in implant prosthesis.

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